Decision Rationale

Total Maximum Daily Load for the Aquatic Life Use Impairment on Stock Creek

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water-quality limited water body.

This document will set forth the U. S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use impairment on Stock Creek. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a MOS.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Stock Creek Watershed is located in Scott County, Virginia. Stock Creek is a tributary to the Clinch River in the Tennessee/Big Sandy River Basin. The benthic impairment on Stock Creek extends 0.69 miles from the impoundment near the former Cyprus Foot Mineral Company to river mile 4.53. The 11,000-acre watershed is rural with forested lands making up 97 percent of the watershed. The remainder of the watershed is composed of residential, agricultural and mined lands.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality listed Stock Creek (VAS-P13R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard due to an aquatic life use impairment identified through benthic

assessments. This decision rationale will address the TMDL for the aquatic life use impairments.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.[1] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[2] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters. Stock Creek first was assessed as moderately impaired at station 6BSTO005.26 in the Fall of 1992. The assessments at this monitoring station have bounced between non-impaired, slightly impaired and moderately impaired based on the reference site from 1992 through 1998. Another monitoring station, 6BSTO004.73, located on Stock Creek just downstream of monitoring station 6BST005.26 was evaluated as moderately impaired from the fall of 1995 through the fall of 1997. The last four RBP II assessments at this site, Spring and Fall 1998, Fall 2003 and Spring 2004, were all found to be non-impaired.

Using the SCI method to evaluate the same assessment data, 6BSTO004.73 was found to be non-impaired in the spring of 2004 and 2005. The proposed impairment threshold for the SCI is 61.3. The last two assessments at this station had SCI scores of 66.20 and 67.54. The last SCI assessment at station BSTO005.26 was a 68.01 in the Spring of 1998. Based on this data the impairment on this stream appears to be minor and conditions appear to be improving.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is necessarily causing the degradation of the benthic community. Additional analysis may be required to determine the pollutants which are causing the impairment as information can be gleaned based on the composition of the community and the condition of the habitat. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of

[1]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[2]Ibid 1

designated uses and water quality criteria.[3]

Historic mining operations conducted formerly by the Cyprus Foote Mineral Corporation and later on the same site by the Chemetall Foote Corporation Sunbright Facility caused degradation to the benthic community of Stock Creek; both operations have since ceased. The operations produced lithium hydroxide and extracted limestone on site. The process produced a large amount of calcium aluminum silicate that was stockpiled on site. Studies conducted in the 1970s and 1980s confirmed that the benthic community below this site was depressed and suspected lithium released from the facility was impacting the stream. Lithium was detected in concentrations below acute thresholds but above the chronic thresholds from 1982 through 1984 in these studies. The last time lithium was found above the chronic concentration was in 1996. Significant remediation work has occurred at the former Cyprus Foote Site since that time, 120,000 cubic yards of calcium aluminum silicate has been removed, the stormwater sedimentation pond was demolished and its wastes removed and a tailings pile was removed. These actions were conducted to halt the release of lithium and other on site materials to the environment. As expected, an improvement in the benthic community of Stock Creek has been observed.

Even with this historic information, it was necessary to determine if another stressor exists in the watershed and at what concentrations this stressor could be assimilated by Stock Creek without negatively impacting its biological community. All possible stressors were evaluated against Virginia's applicable numeric water quality criteria. For those stressors without state approved criteria, the 90th percentile of water-quality data from 49 Southwestern Virginia benthic reference stations was used. Based on this comparison, pollutants were determined to be non-stressors, possible stressors or most probable stressor. Sediment was determined to be the most probable stressor. However, a numeric water quality criterion does not exist for sediment. Therefore, a reference watershed approach was used to determine the numeric endpoint for the sediment load to Stock Creek. Numeric endpoints represent the water-quality goals that are to be achieved through the implementation of the aquatic life use TMDL which will allow the impaired water to attain its designated use. A reference watershed approach is based on selecting a non-impaired watershed that shares similar land use, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards. Stony Creek was used as the reference watershed for Stock Creek.

The benthic TMDL was developed using the Generalized Watershed Loading Function model (GWLF). The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[4] GWLF is a continuous simulation model that uses daily time steps for weather

[3]Ibid 1

[4]Ibid 1

data and water balance calculations.[5] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. A mass balance model to predict the concentrations of metals in stream sediments was used in combination with the GWLF to determine the loading of metals to the stream.

Table 1 - Summarizes the Specific Elements of the TMDL.

Segment	Parameter	TMDL	WLA	LA	MOS
Stock Creek	Sediment (Mg/yr)	2,643	0.0	2,379	264

The United States Fish and Wildlife Service has been provided with a copy of the TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing an aquatic life (benthic) use impairment TMDL for Stock Creek. EPA is therefore approving the TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

As stated above, the biological assessments on Stock Creek were not able to discern a clear stressor to the Creek, though historic data pointed to lithium which is no longer observed at chronic concentrations in the water. The TMDL modelers therefore conducted a stressor identification analysis to determine what was impacting the benthic community. Ambient water quality data was able to rule out dissolved oxygen, temperature or pH as possible stressors to Stock Creek. An excessive loading of sediment was seen as the cause of the benthic impairment on Stock Creek. This determination was based on the results of several habitat assessments. In high enough concentrations, sediment can have detrimental impacts on the benthic community. Sediment fills interstitial spaces that provide habitat for many organisms. Excessive levels of sediment may also clog an organisms gill surfaces thus lowering its respiratory ability. Lastly, excessive sediment increases turbidity which lowers the feeding efficiency of visual predators.

The GWLF model was used to determine the loading rates of sediment to the impaired and reference stream from all point and nonpoint sources. The TMDL modelers determined the sediment loading rates within each watershed. Data used in the model was obtained on a wide array of items, including land uses in the area, point sources in the watershed, weather, stream geometry, etc..

[5]Ibid 1

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from the National Climatic Data Center station 440735. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of vegetative, land slope, soil erodibility, and land practices used in the area.[7] Parameters within the model account for these conditions and practices. A stream channel erosion model was added to GWLF to account for this source of sediment. The GWLF model was developed to simulate hydrology in ungaged watersheds. However, to ensure that the hydrology was accurately simulating the system the model was calibrated to a United States Geological Survey gage in Stony Creek, the reference station.

The appropriate sediment loading to Stock Creek was determined based on the simulated sediment load to Stony Creek. Since Stony Creek is a non-impaired watershed similar in land use and size to Stock Creek, it is assumed that the sediment loading to this Stony Creek would allow Stock Creek to contain a non-impaired benthic community. Based on the most recent water quality data, it appears as though the biological impairment on Stock Creek is limited.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land-based precipitation-driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There are no facilities actively discharging sediment to Stock Creek at this time. There is a small area of abandoned mine land in the watershed, that was originally modeled as a point source. However, there is no active point source discharging in this area and the WLA was removed. For the calibration, the Cyprus Foote Mineral facility was modeled as a point source

[6]Ibid 1

[7]Ibid 1

since it was discharging wastes to Stock Creek during that time. The facility is no longer discharging at this time and no WLA was provided.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished. The GWLF model was used to ascertain the sediment loading to Stock Creek and Stony Creek the reference watershed. The model provides the monthly sediment load to the stream through the use of the universal soil loss equation (USLE). The USLE derives the sediment loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Table 2 identifies the current and TMDL loading for sediment to Stock Creek.

Table 2 - LA for Sediment for Stock Creek

Source Category	Existing Load (Mg/yr)	Proposed Load (Mg/yr)	Percent Reduction
Forest Undisturbed	50	50	0
Agriculture	701	409	43
Forest Disturbed	3,225	1,814	44
Developed	17	17	0
Quarries and Mines	126	72	43
Streambank	36	21	43

3) The TMDL considers the impacts of background pollution.

The TMDL considers the impact of background pollutants by considering the sediment loadings from background sources such as forested land.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water-quality of Stock Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[8]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period to insure that it accounted for a wide range of climatic conditions. The allocations developed in these TMDL will therefore insure that the criterion is attained over a wide range of environmental conditions including wet and dry weather conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Consistent with the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and by modifying waste application rates, crop cycles, and livestock practices.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using

[8]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. An explicit 10 percent MOS was used for the sediment TMDL.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

During the development of the TMDL for the Stock Creek Watershed, public meetings were held to discuss and disseminate the TMDL. A basic description of the TMDL process and the agencies involved was presented at the first public meeting on July 19, 2005 at the Cove Ridge Center Natural Tunnel State Park in Duffield, Virginia with 30 people in attendance. The second public meeting was held on January 17, 2006 at the same location with 20 people in attendance. Notices for the public meetings were placed in the Scott County Star, sent out in local mailings and signs posted in the watershed. Both meetings were open to a 30-day public comment period.